NOAA GFDL 1-page Research Summary

Response to CO_2 doubling of the Atlantic Hurricane Main Development Region in a High-Resolution Climate Model

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A purpose: Response of SST in the Atlantic Hurricane Main Development Region (SST_{MDR}) to CO_2 doubling has been explored, using the new high-resolution coupled Climate Model version 2.5 developed at the Geophysical Fluid Dynamics Laboratory (GFDL-CM2.5).

Key Findings: In the annual mean, the SST_{MDR} warms by about 2°C in the CO_2 doubling run relative to the Control run, the trade winds become weaker in the northern tropical Atlantic, and the rainfall increases over the ITCZ and its northern region. The amplitude of the annual cycle of the SST_{MDR} is not significantly changed by CO_2 doubling. However, we find that the interannual variations show significant responses to CO_2 doubling: the seasonal maximum peak of the interannual variations of the SST_{MDR} moves from boreal spring to early boreal summer, at which time it is about 25% stronger than in the Control run. The enhancement of the interannual variations of the SST_{MDR} is due to changes in effectiveness of the Wind-Evaporation-SST (WES) positive feedback: WES remains a positive feedback until boreal early summer in the CO_2 doubling run. This change in the interannual variability will be a factor in predicting the year-to-year risk of serious damages associated with the Atlantic Hurricane and drought (or flood) in the Sahel and South America in a future climate.

Unique Aspects: Most previous work has mainly focused on response of the annual mean SST to a future climate and relatively less attention has been paid to response of the interannual variations to radiative forcing changes. In this manuscript, we find a significant change of the interannual variations due to CO_2 doubling: the maximum peak of the interannual variations of SST_{MDR} in the CO_2 doubling run moves from boreal spring to early boreal summer, at which time it is about 25% stronger relative to the Control run. The enhancement of the interannual variation of SST_{MDR} in boreal early summer also seems to appear in observation, although there are some uncertainties among observational datasets. The large amplitude of the interannual variation of the SST_{MDR} in boreal early summer due to CO_2 doubling enhances the year-to-year variation of the Atlantic Hurricane count.